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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/549,285	09/16/2005	Kazuyoshi Yamazaki	278536US26PCT	2471
22850	7590	05/17/2010	EXAMINER	
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314			CHEN, KEATH T	
			ART UNIT	PAPER NUMBER
			1712	
			NOTIFICATION DATE	DELIVERY MODE
			05/17/2010	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com  
oblonpat@oblon.com  
jgardner@oblon.com

<b>Office Action Summary</b>	<b>Application No.</b> 10/549,285	<b>Applicant(s)</b> YAMAZAKI ET AL.	
	<b>Examiner</b> KEATH T. CHEN	<b>Art Unit</b> 1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2010.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 33-35,38,39,41 and 45-55 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 33-35,38,39,41 and 45-55 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                     |                                                                   |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)         | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____                                                         | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/30/2010 has been entered.

### ***Response to Amendment***

1. Applicants' amendment, filed on 03/30/2010, in response to the rejection of claims 33-35, 38, 39, 41, and 45-53 in the final office action mailed on 09/30/2009, by amending claims 33-35, 38, 39, 41, and 46-53, cancelling claim 45, and adding new claims 54-55 is acknowledged and will be addressed below.

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. **Claims 33-35, 38-39, 41, and 45-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al. (US 6407405, hereafter '405), in view of Anders (US 20020000779, hereafter '779), Aoyama et al. (US 20040023513, hereafter '513), and Roth et al. (DE 4007523, hereafter '523).**
3. '405 teaches some limitations of:

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4. Claim 33: A substrate processing apparatus (Fig. 1) comprising: a processing vessel (chamber #1, col. 3, line 3) forming a processing space; a supporting table (substrate holder, #3, col. 3, line 27) for supporting a substrate (S) to be processed in the processing space, the substrate having a surface to be processed (the surface facing the radical generation units); a first remote radical generation unit (#41, col. 3, lines 53-55), provided at a first sidewall portion of the processing vessel, for forming first radicals by a high frequency plasma (RF, col. 3, line 55) and supplying the first radicals into the processing space through a first gas outlet provides at the first sidewall portion (#41 intrinsically having a gas outlet); a second remote radical generation unit (#31, col. 3, lines 48-51) for forming second radicals by a high frequency plasma (RF, col. 3, line 51) and supplying the second radicals into the processing space through a second gas outlet provides at the first sidewall portion (#31 intrinsically having a gas outlet); a gas exhaust port (label "P", vacuum pump #2, col. 3, line 4), provided at a second sidewall portion of the processing vessel, to exhaust the processing space, the second sidewall portion being disposed opposite to the first sidewall portion with the supporting table placed therebetween (S is between #41 and pump "P").

5. '405 does not teach the other limitations of:

6. Claim 33: (33A) a rotatable supporting table, (33B) (a second remote radical generation unit) provided at the first sidewall portion of the processing vessel, the first and the second radicals are respectively introduced into the processing space from the first and the second gas outlets along a first flow path and a second flow path which are

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substantially parallel to the surface of the substrate mounted on the supporting table, (33C) a flow adjusting plate provided in the vicinity of the first gas outlet and configured to change a direction of the first flow path by an angle 0 to thereby direct the first radicals introduced from the first gas outlet along the first flow path whose flow direction has been changed.

7. '779 is an analogous art in the field of semiconductor processing ([0004] '405 field of the invention), particularly in array of plasma (field of the invention). '779 provides a parallel array of plasma (Fig. 9, [0093]), for the purpose of a compact small diameter source design ('779, [0046]).

8. At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have consolidated various plasma sources in the combined apparatus of '405 into a rectangular parallel array of plasma, as taught by '779, for the purpose of a compact small diameter source design, as taught by '779 ([0046]). Note with parallel array of plasma, all plasma source outlets are at the same/first plane, the first and the second radicals are respectively introduced into the processing space from the first and the second gas outlets along a first flow path and a second flow path which are substantially parallel to the surface of the substrate mounted on the supporting table (the limitations of 33B),

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9. '513 is an analogous art in the field of semiconductor treatment system (title; '405 field of the invention). '513 teaches a reactor #610 with remote plasma source (#93, Fig. 47, [0281], line 1-5) to provide nitrogen or oxygen radical ... flow along the surface of the substrate 62W (parallel to the surface of the substrate), and ultraviolet source 74A to provide oxygen radical from nozzle 61A ([0281]). '513 further teaches rotating the substrate for the purpose of uniformity ([0262], lines 1-5).

10. At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have arranged the parallel array of plasma in the combined apparatus of '405 and '779, in parallel to the substrate surface and to have added a rotation mechanism (the limitations of 33A), as taught by '513, to drive the substrate holder (#3) of '405, for the purpose of uniformity ('513, [0262], lines 1-5). The motivation to place the inlet in parallel with the substrate surface is suitability. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

11. '523 is an analogous art in the field of plasma processing (title), particularly in plurality of plasma source to form mixture for surface treatment (Abstract). '523 teaches a pivotable diaphragm (#6, col. 2, lines 29-33; English translation, page 2, paragraph 6, lines 4-5) of the plasma source (#2, lines 3-6 of page 2, the limitations of 33C), for the purpose of preventing premature evaporation, as taught by '523 (English translation, page 2, paragraph 6, lines 4-5). Note by turning the pivotable diaphragm to an angle  $\theta$

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relative to the ion path would have changed the first flow path by that angle.

12. At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have replaced the shutter S3 and S4 of '405 in the combined apparatus of '405, '779, and '513 with a pivotable diaphragm (the claimed flow adjusting plate that is capable of interfering with the first flow path to change a flow direction of the first radical), as taught by '523 (Fig. 1). The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

13. '405, '513, and '523, together, disclose the claimed invention except for (the oxygen radical generation unit) at the first plane of the sidewall at the first side. It would have been an obvious matter of design choice to re-arrange the generation units at the same plane of the sidewall, since it has been held that rearranging parts of an invention only involves routine skill in the art. *In re Japikse*, 86 USPQ 70.

14. In addition to the limitations of 33 which applies to Claim 41, '513 each further teaches the limitations of:

15. Claim 41: the second flow path being directed toward a center of the substrate when viewed from above the surface of the substrate. (nitrogen radicals reach the central part of the substrate W ([0259], see Figs. 39-42).

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16. At the time the invention was made, it would have been obvious to a person having ordinary skill in the art to have arranged the nitrogen remote plasma, as taught by '513, of the parallel array of plasma source (from '779) to the central part of the substrate, for its suitability with predictable results. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

17. '405 further teaches the limitations of:

18. Claims 34 and 48: The substrate processing apparatus of claim 33 (or 41), wherein the first remote radical generation unit is a nitrogen radical generation unit (#41, col. 3, lines 53-55) and the second remote radical generation unit is an oxygen radical generation unit (#31, col. 3, lines 48-51).

19. Claims 46 and 52: The substrate processing apparatus of claim 33 (or 41), wherein the first remote radical generation unit is an oxygen radical generation unit (#31, col. 3, lines 48-51) and the second remote radical generation unit is a nitrogen radical generation unit (#41, col. 3, lines 53-55).

20. '779, in the above combination, teaches the limitations of:

21. Claims 35 and 49: The substrate processing apparatus of claim 34 (or 48), wherein the nitrogen radical generation unit (one of the four in Fig. 9) includes a first gas passageway (one of the cell #160) and a first high frequency plasma generation unit ('405, RF, col. 3, line 55) formed at a part of the first gas passageway to excite a



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nitrogen gas passing therethrough into a plasma; and the oxygen radical generation unit (another one of the four in Fig. 9) includes a second gas passageway (another one of the cell #160) and a second high frequency plasma generation unit (RF, col. 3, line 51) formed at a part of the second gas passageway to excite an oxygen gas passing therethrough into a plasma, wherein the first and the second gas passageway are in communication with the processing space through the first and second gas outlets, respectively (see the arrows of Fig. 9).

22. Claims 47 and 53: The substrate processing apparatus of claim 46 (or 52), wherein the oxygen radical generation unit (one of the four in Fig. 9) includes a first gas passageway (one of the cell #160) and a first high frequency plasma generation unit ('405, RF, col. 3, line 55) formed at a part of the first gas passageway to excite a oxygen gas passing therethrough into a plasma; and the nitrogen radical generation unit (another one of the four in Fig. 9) includes a second gas passageway (another one of the cell #160) and a second high frequency plasma generation unit (RF, col. 3, line 51) formed at a part of the second gas passageway to excite an nitrogen gas passing therethrough into a plasma, wherein the first and the second gas passageway are in communication with the processing space through the first and second gas outlets, respectively.

23. The above combination of '405, '513, '779, and '523 also would have met the limitations of:

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24. Claims 39 and 50: The substrate processing apparatus of claim 33 (or 41), wherein a center line of the first flow path whose flow direction has been changed (by adjusting the angle of the imported pivotable diaphragm that replaced S3 and S4) intersects with that of the second flow path substantially directly above a center of the substrate mounted on the supporting table.

25. Claim 51: The substrate processing apparatus of claim 41, wherein the first radicals and the second radicals ('779, from the parallel plasma array) are respectively introduced into the processing space while flowing substantially parallel to the surface of the substrate on the supporting table ('513, Fig. 47, from the inlet direction).

26. Claim 38: The substrate processing apparatus of claim 33, wherein the distance between a center line of the second flow path and a center of the substrate mounted on the supporting table is 40 mm or less (by adjusting the angle of the imported pivotable diaphragm that replaced S3 and S4).

27. Claims 54-55: The substrate processing apparatus of claim 33 (or 41), wherein the first flow path whose flow direction has been changed and the second flow path are directed toward the substrate mounted on the supporting table (by adjusting the angle of the imported pivotable diaphragm that replaced S3 and S4).

### ***Response to Arguments***

Applicant's arguments filed 03/30/2010 have been fully considered but they are not persuasive.

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28. In regarding to 35 USC 103 rejection of claims 33-35, 38-39, 41, and 45-53 based on '405, '513, '779, and '523, Applicants argue that in Roth '523 lacks teaching for directing the flow of boron vapor described therein, merely state that pivotable diaphragm (6 ) prevents premature evaporation onto a substrate, acts as a mere shutter, is silent on what is performed by the pivotable diaphragm when the shutter is open, see the bridging paragraph of page 10 and 11.

This argument is found not persuasive.

The examiner maintains that the pivotable diaphragm (6) of '523 is **capable** of changing the flow direction of boron ions at any angle.

29. Applicants argue that, on the second page of the attachment, the wavy line on Fig. 1 of '523 is not a track of boron vapor emitted from the source, see the first complete paragraph of page 11.

This argument is not relevant to the examiner's rejection. The examiner is not counting the wavy line as indication of changing flow direction. The examiner considers a plate, when placed in the ion path at certain angle, will change the direction of ion, similar to Applicants' plate 26f in Fig. 10B.

The examiner notices that the Applicants fail to submit attachment.

30. Applicants further argue that the examiner is mistaken in asserting that the pivotable diaphragm provides a **motivation** for adding a flow adjusting plate to Sano '405, the presence of a shutter blocking the gaseous source would merely randomly scatter the radicals, see the second complete paragraph of page 11.

These arguments are found not persuasive.

As stated in the item 11 of the last office action (09/30/2009), the motivation to add a rotating diaphragm/flow adjusting plate is to prevent premature evaporation, as taught by '523 (English translation, page 2, paragraph 6, lines 4-5). Note it is added to the combined apparatus of '405, '513, and '779, not merely to '405.

The examiners maintains that the pivotable diaphragm (6) of '523 is **capable** of changing the flow direction of boron ions at any angle, when rotated pivotable diaphragm at certain angle to the ion flow path, similar to Applicants' plate 26f in Fig. 10B.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEATH T. CHEN whose telephone number is (571)270-1870. The examiner can normally be reached on 6:30AM-3 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEATH T CHEN/  
Examiner, Art Unit 1712